

InnoGrit Utility User's Guide

INNOGRIT Corporation

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Version	Date	Editor	IGU version	Description
0.2	05/17/2019	Wei Hou	v1.0.0.2	First release
0.4	06/12/2019	Wei Hou	v1.0.0.4	Add Chapter 5/6, LED Indicator, other updates

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Preface

About this user's guide

Welcome to IG Utility user's guide. IG Utility, short for IGU, is a production utility for Solid State Drive (SSD) based on Innogrit SSD controller. IGU provides an integrated environment for downloading firmware, getting all kinds of information, erasing SMART information, changing basic setting and others which is aimed to improve working efficiency in lab and factory. IGU is very powerful, at the same time, IGU has a user-friendly interface, and it's very easy for use.

So, let's begin and enjoy!

Innogrit Confidential

Chapter 1: Hardware Setup

Test Setup

A NVMe SSD drive should be connected to PC through native PCIe interface or USB interface by using USB to NVMe adaptor. User can use either way. For the USB to NVMe adaptor, ASMedia chip ASM2362 can support IGU, while JMicron chip will support IGU soon.

Please make sure that SSD drive connected firmly and PC is in a good health before running IGU.

LED Indication Behavior

Status Definition:

Behavior during normal mode needs firmware update (not part of IGU)

Behavior during recovery mode and RDT testing is ready as below

v1.0.0.4 IGU supports GPIO4 (output High as On, Low as Off) as LED indicator

Behavior Definition:

- a. LED Always OFF
- b. LED Always ON
- c. LED ON/OFF/ON once (around 1s interval)
- d. LED Blinking Fast (around 50ms interval)
- e. LED Blinking Slow (around 1s interval)
- f. LED Blinking Dim (around 1s interval and 10% Dimming)

Behavior during normal mode (needs firmware update):

- a. Normal Power Up: ON/OFF/ON
- b. Normal Read/Write: Blinking Fast
- c. Normal Idle: Always OFF

Behavior during recovery mode:

- a. 2GB/4GB Power Up: Blinking Dim

Behavior during RDT testing:

- a. Power Ready: Blinking Dim
- b. Under testing: Blinking Slow
- c. Stop or Error: Always OFF
- d. RDT PASS: Always ON
- e. Bad Blocks Over Spec: Blinking Fast

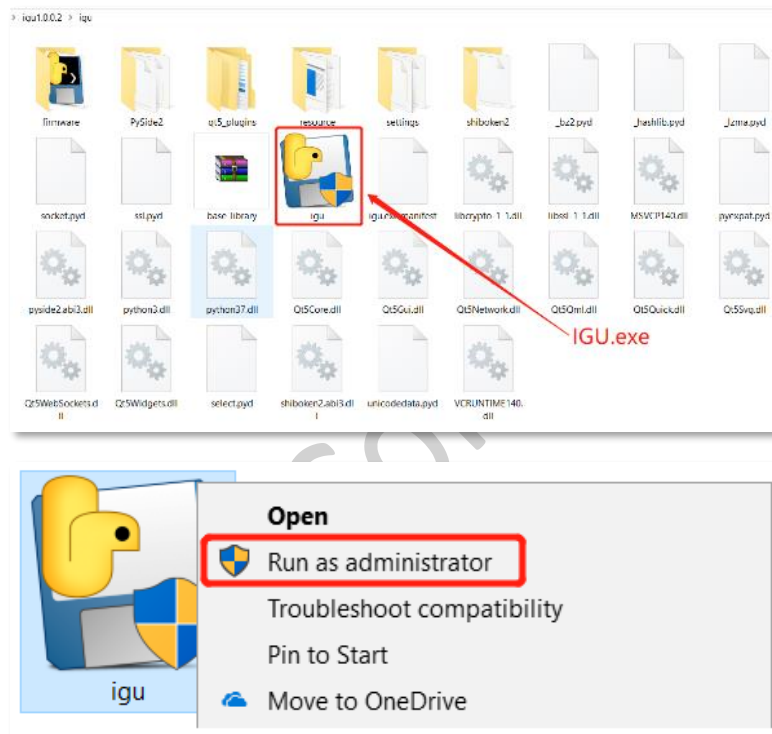
Chapter 2: IG Utility Introduce

IGU Running

IGU can be running under Windows 10 or Windows 7 operating system. Since Windows 7 cannot native support NVMe, Window 7 Service Pack 1 (SP1) and related hotfix should be installed if user connects the SSD Drive to motherboard's PCIe interface directly, not through USB to PCIe bridge. Please contact with Innogrit for support if needed.

On Windows operating system, user must have administrative privileges. User can run IGU without installation.

To run IGU, please right click IGU.exe, and select run as administrator.



IGU Window

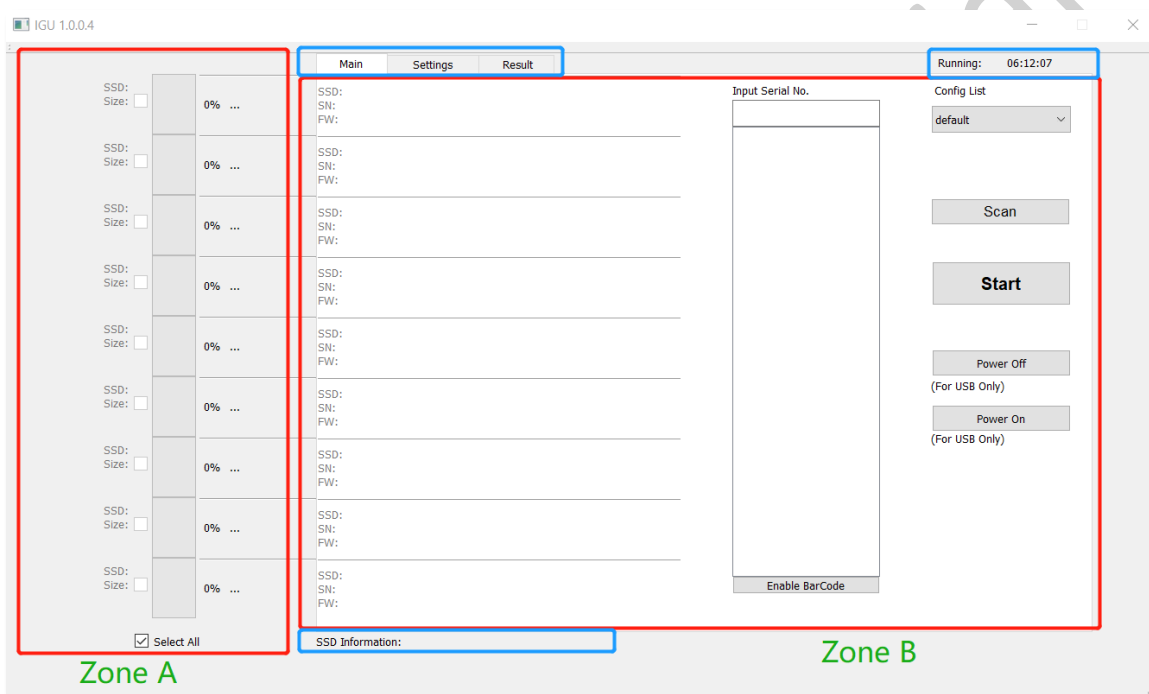
Zone A shows the basic information of SSD drives connected to the PC. It supports up to 16pcs SSD drives at the same time. For every SSD drive, it shows SSD model name, firmware version, capacity, check status. Zone A is docked on the left area of the window.

There are three tabs above Zone B. They are *Main*, *Settings* and *Result*. Zone B changes if selecting different tab, while Zone A keeps the same.

- *Main* tab is for showing key information, showing status, executing.
- *Setting* tab is for setting key information, selecting firmware and showing SMART information.
- *Result* tab is for showing test result.

Running shows the time with IGU.

SSD Information shows the basic information of the SSD drive.



IGU Window – *Main* tab

Area A contains SSD Model Name, SN, FW version and Mode.

Area B is for bar code scanner input. Click *Enable BarCode* button to enable this function.

Area C contains many items, from top to bottom:

Running: time passes

Config List: select the configuration from the list already exist

Scan: scan the SSD Drive after hot plug the USB adaptor

Start: execute the commands according to the setting in *Setting* tab

Power Off: turn the SSD drive power supply off (only for the setup using USB to PCIe adaptor)

Power On: turn the SSD drive power supply on (only for the setup using USB to PCIe adaptor)

Area D is showing the SSD drive basic information and debug information

Main	Settings	Result
SSD: IG5208 SN: B800000000000000000007 FW: x.x.1.x		
Mode: Normal		
SSD: SN: N/A FW:		
SSD: SN: N/A FW:		
SSD: SN: N/A FW:		
SSD: SN: N/A FW:		
SSD: SN: N/A FW:		
SSD: SN: N/A FW:		
SSD: SN: N/A FW:		
SSD: SN: N/A FW:		
SSD: SN: N/A FW:		

Input Serial No.

Running: 00:12:11
 Config List
 default

 (For USB Only)

 (For USB Only)

SSD Information: Super Blocks-504 PGcnt-2304 SLC PGcnt-768 CH-4 CE-2 LUN-1 PLN-2

IGU Window – Setting tab

Area A allows user to set Model Name, S/N, Form Factor, PCI-VID, PCI-SSVID.

Area B contains timing related setting. (GUI only, no function in IGU v1.0.0.4)

Area C contains Enable UART, NAND DLL Setting. (GUI only, no function in IGU v1.0.0.4)

Area D contains RDT aging test related parameters and options.

Area E allows user to select *Programmer* and *FTK Combo* firmware under *Recovery Mode*.

Programmer and *FTK Combo* firmware image can be left blank for using default files.

Area F allows user to save or load settings from local PC or SSD drive.

Area G allows user to do following things:

- Select *FW Image* under *Normal Mode* (left blank for using default firmware)
- Check *Erase SMART* option
- Check *Go Back Recovery Mode (Virgin Device)* option
- Set *Temperature Threshold* (only for using USB to NVMe adaptor)
 - Temperature Threshold 1*: Thermal Management Temperature 1 (TMT1) in NVME spec.
 - Temperature Threshold 2*: Thermal Management Temperature 2 (TMT2) in NVME spec.
 - Temperature Threshold 2* should be greater than *Temperature Threshold 1*.
- Get *SMART* button for getting and showing SMART information
- Get *Temperature* button for getting and showing SSD controller internal Temperature

The screenshot shows the 'Settings' tab of the IGU application. The interface is organized into several functional areas, each highlighted with a green letter (A-G) in the original image:

- Area A:** Fields for Model Name (IG5208), S/N (BB00000000000000000009), Begin SN, End SN, Form Factor (BGA), FW Revision, PCI-VID (1DBE), and PCI-SSVID (5208).
- Area B:** Timing settings including OP (Default), NAND Timing (Default), CPU clk (575M), WCTEMP (Default), and CCTEMP (Default).
- Area C:** Enable UART (unchecked) and Manual NAND DLL Settings (checked) with CH0, CH1, CH2, and CH3 values.
- Area D:** RDT Parameters including Do RDT (unchecked), Check RDT result (checked), Keep RDT result (checked), Loop Count (4), and ECC Threshold (60).
- Area E:** Recovery Mode (Virgin Device) settings including Programmer, FTK Combo, Quick Defect Scan (unchecked), and Pretest (checked).
- Area F:** Buttons for Load Config, Save to File, Save As..., and Save to SSD.
- Area G:** Normal Mode settings including FW Image, Erase SMART (unchecked), Go Back Recovery Mode (unchecked), Temperature Threshold1, and Temperature Threshold2.

On the right side, there are two data tables:

Attribute	Value
temperature	56 C
available_sp...	100%
available_sp...	10%
percentage_...	0%
data_units_r...	0
data_units_...	0
host_read_c...	9
host_write_c...	0
controller_b...	0

Thermal ...	Value
Thermal ...	358 Kelvin
Thermal ...	363 Kelvin

At the bottom, the SSD Information is displayed: Super Blocks-504 PGcnt-2304 SLC PGcnt-768 CH-4 CE-2 LUN-1 PLN-2.

IGU Window – Result tab

Area A allows user to get detail test result.

Area B contains detail information of NAND flash ID.

Area C shows the overall defect information.

Area D shows the RDT test result.

Area E shows the new-found defect PDA.

The screenshot displays the 'Result' tab of the IGU window. The interface is divided into several sections, each highlighted with a red border and a green letter label (A-E).

Area A: Get Details

Get Details

Result:

Total Fail Counts:

Fail threshold: /Die

Total Dies:

Nand Type:

Runtime: S

Max Temperature: C at

Timing Mode TM9

Area B: Flash ID

CH	CE	B[0]	B[1]	B[2]	B[3]	B[4]	B[5]
0	0	0x89	0xa4	0x8	0x32	0xa1	0x15
0	1	0x89	0xa4	0x8	0x32	0xa1	0x15
1	0	0x89	0xa4	0x8	0x32	0xa1	0x15
1	1	0x89	0xa4	0x8	0x32	0xa1	0x15
2	0	0x89	0xa4	0x8	0x32	0xa1	0x15
2	1	0x89	0xa4	0x8	0x32	0xa1	0x15
3	0	0x89	0xa4	0x8	0x32	0xa1	0x15
3	1	0x89	0xa4	0x8	0x32	0xa1	0x15

Area C: Overall Defect List

CH	CE	LUN	Overall
0	0	0	24
0	1	0	20
1	0	0	19
1	1	0	17
2	0	0	16
2	1	0	17
3	0	0	14
3	1	0	12

Area D: RDT Loop Information

Loop	Defects
0	0
1	0
2	0

Area E: New Found Defect PDA

ID	PDA
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SSD Information: Super Blocks-504 PGcnt-2304 SLC PGcnt-768 CH-4 CE-2 LUN-1 PLN-2

Chapter 3: Open Card and Firmware Upgrade

Purpose

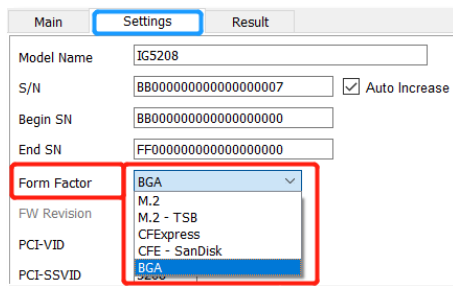
During open card stage, including RDT open card, normal open card and second time open card, user can download the firmware with different setting through IGU.

User can upgrade firmware by following the steps below.

Step by Step

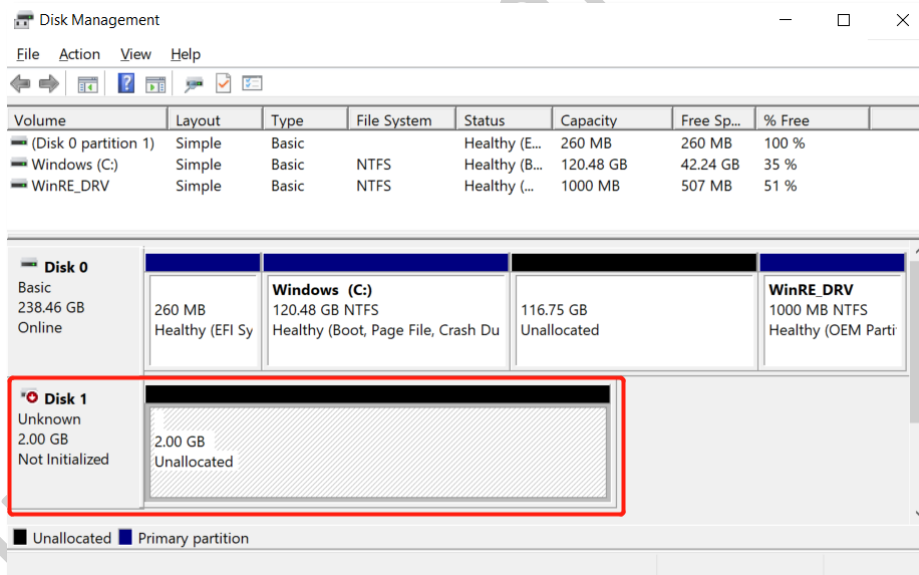
Step 0: Hardware setup ready, then run IGU.exe

Step 1: Select correct *Form Factor* from *Setting* tab

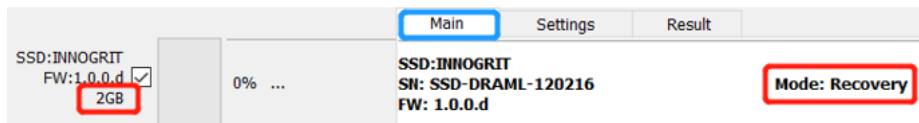


Step 2: 2GB size check if the SSD drive is brand new (virgin device). Otherwise skip this step.

a. Check Disk Management in Windows to make sure the capacity of SSD drive is 2GB.



b. Check information in IGU to make sure the capacity is 2GB under Recovery mode.



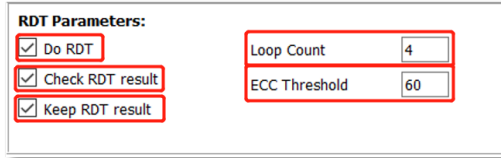
Step 3: Option setting for RTD open card. Skip if not for RTD open card

Please make sure the SSD drive is virgin device. Reference step 2.

In *Setting* tab, check the checkbox of *Do RDT*; *Check RDT result*; *Keep RDT result*

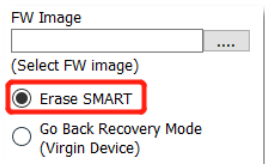
Loop Count: fill the number of loops for RDT test

ECC Threshold: leave it as default value



Step 4: Option setting for second time open card. Skip if not for second time open card

In setting tab, check *Erase SMART* option

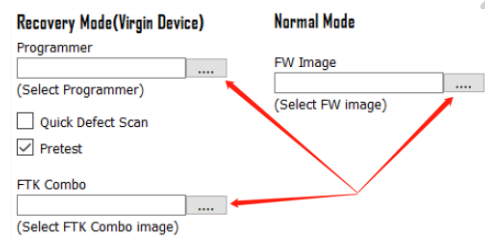


Step 5: Programmer and firmware selection. Skip if using default files

In setting tab, user can load special programmer or firmware, or leave it blank for default files.

For firmware upgrading, select firmware file in *FW Image* selection box under *Normal Mode*.

If multi-LUN NAND is used, select related firmware in *FTK Combo* or *FW Image* selection box.

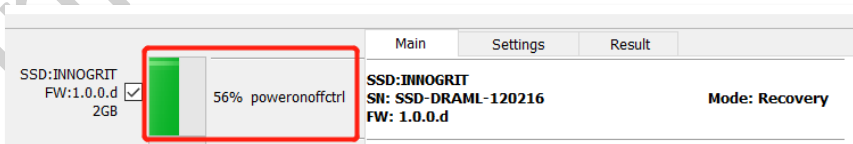


Step 6: Execute, then done

In *main* tab, press *Start* button.

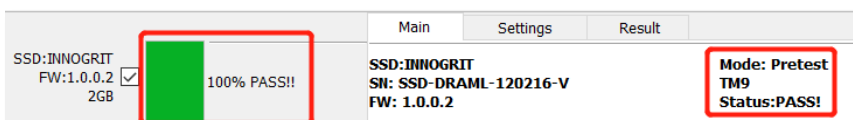


Progress status will be shown during executing.



Execution result will be shown when finished.

For detail information, please select *Result* tab, then click *Get Details* button.



Chapter 4: Result Check

Purpose

After RDT aging test or second time open card, user can check the result through IGU.

RDT Aging Result Check

In result tab, check the RDT Loop Information and Overall Defect List.

The screenshot displays the 'Get Details' tab in the software interface. The 'Result' field is highlighted with a red box and shows 'Bypass'. Below it, various parameters are listed: Total Fail Counts (139), Fail threshold (52), Total Dies (8), Nand Type (MU), Runtime (0), Max Temperature (empty), and Timing Mode TM9. To the right, the 'Overall Defect List' table shows data for CH, CE, LUN, and Overall counts. Further right, the 'RDT Loop Information' table shows Loop numbers and Defects.

CH	CE	LUN	Overall
0	0	0	24
0	1	0	20
1	0	0	19
1	1	0	17
2	0	0	16
2	1	0	17
3	0	0	14
3	1	0	12

Loop	Defects
0	0
1	0
2	0

RDT Test Result:

Bypass: If *Check RDT Result* check box in *setting* tab is not checked, the *result* shows *Bypass*.

Pass: If quantity of failed blocks is less than number in *Fail Threshold*, the *result* shows *Pass*.

Fail: If quantity of failed blocks is more than number in *Fail Threshold*, the *result* shows *Fail*.

Second Time Open Card Result Check

In setting tab, check the SMART information by click Get SMART button.

The screenshot shows the 'Get Smart' button and a table of SMART attributes and their values.

Attribute	Value
temperature	56 C
available_sp...	100%
available_sp...	10%
percentage_...	0%
data_units_r...	0
data_units_...	0
host_read_c...	9
host_write_c...	0
controller_b...	0

Chapter 5: Settings Update

Purpose

All information in Setting tab area A/B/C/D can be updated at any stage of the test. User can use the following way to update information.

The screenshot shows the 'Settings' tab of the IGU application. The interface is divided into several sections, with specific areas highlighted in red and labeled A through F:

- Area A:** Model Name (IG5208), S/N (BB000000000000000009), Begin SN (BB000000000000000000), End SN (FF000000000000000000), Form Factor (BGA), FW Revision, PCI-VID (1DBE), and PCI-SSVID (5208).
- Area B:** OP (Default), Nand Timing (Default), CPU clk (575M), WCTEMP (Default), CCTEMP (Default), and RDT Parameters (Do RDT, Check RDT result, Keep RDT result).
- Area C:** Manual NAND DLL Settings (CH0, CH1, CH2, CH3) and Temperature Threshold1/2.
- Area D:** RDT Parameters (Do RDT, Check RDT result, Keep RDT result) and Loop Count/ECC Threshold.
- Area E:** Recovery Mode (Virgin Device) section including Programmer, Quick Defect Scan, Pretest, and FTK Combo.
- Area F:** Normal Mode section including FW Image, Erase SMART, Go Back Recovery Mode, and Temperature Threshold1/2.

Additional elements include 'Load Config', 'Save to File', 'Save As ...', 'Save to SSD', 'Get Smart', and 'Get Temperature' buttons. The bottom status bar shows 'SSD Information: Super Blocks-504 PGcnt-2304 SLC PGcnt-768 CH-4 CE-2 LUN-1 PLN-2'.

Step by Step

- Step 0: Hardware setup ready, then run IGU.exe
- Step 1: Change information in Area A/B/C/D from *Setting* tab
- Step 2: Click *Save to SSD* or *Save to File* from *Setting* tab
- Step 3: *Power Off*, then *Power on* from *Main* tab
- Step 4: Check the *SSD Name* and *S/N* result in module information from *Main* tab

Note 1: If *Auto Increase* Check Box from *Settings* tab is checked, information will be updated during firmware download no matter *Save to SSD* button or *Save to File* button is clicked.

Note 2: If SSD driver cannot be recognized after power cycle, please remove the USB cable from PC, then plug the USB cable in again.

Chapter 6: Back to Virgin Device Mode

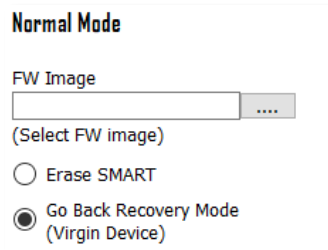
Purpose

If user wants to change the SSD Drive from normal mode to virgin device mode (recovery mode), please follow the steps below.

Step by Step

Step 0: Hardware setup ready, then run IGU.exe

Step 1: Select *Go Back Recovery Mode (Virgin Device)* in *Normal Mode* from *Setting* tab

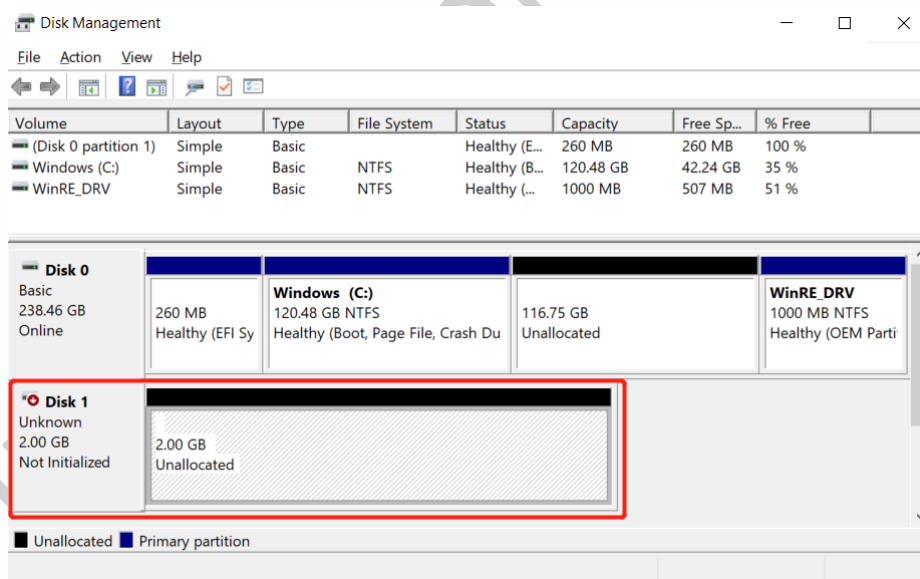


Step 2: Execute, then done. In *main* tab, press *Start* button.

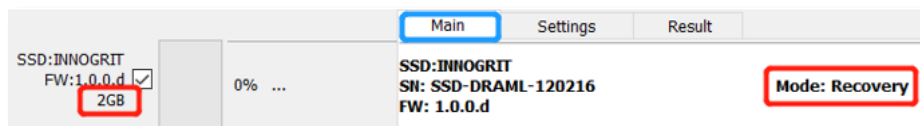


Step 3: Check if the SSD drive is in virgin device mode.

a. Check Disk Management in Windows if the capacity of SSD drive is 2GB.



b. Check information in IGU if the capacity is 2GB under Recovery mode.



Appendix: IGU Version Change List

v1.0.0.4 Main Change List

GUI (igu.exe)

- Add re-init for PCIE interface about pretest and virgin open card flow.

- Add capacity check if it's smaller than 16.

- Enhance pretest. For 2nd press start, auto check defects cnt, if too much defects, display "failed".

- Adjust delay time for different conditions. By far, added more delay if there's NO MR in NAND.

Middleware (middle.exe)

- No changes

Loader (MP programmer.fw – 1.0.0.3)

- Resolved issue with the module which has MP info by adding more checks.

- Return Zero data when the MP head is mismatch.

- Enhance pretest: for passed condition, set different header for different conditions in case to precisely control delay.

- LED behavior: if there're too many defects found, fast blinking LED, and GUI showing "failed".

Aging firmware (rdt.fw - 1.0.0.3)

- Remove code only used for programmer stage.